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ALTERNATIVE ENERGY: HYDROGEN FUEL CELLS

by Chris Woodford: *September 20, 2016.*

A century or so ago, the number of cars on Earth numbered in the thousands. Today, there are something like a billion cars—roughly one for every seven people on the planet. Think of Earth as a giant gas station with only a limited supply of fuel and you'll realize quite quickly that we have a problem. Many geologists think we're reaching a point they call "peak oil" and, in the next few decades, supplies of gasoline (and everything else made from petroleum) will start to dwindle. If that happens, where will all our cars get their fuel from? The short-term fix is to get better fuel efficiency from existing cars. In the longer term, the solution may be to switch vehicles over from gasoline engines and diesel to electric **fuel cells**, which are a bit like batteries powered by hydrogen gas that never run flat.

Silent and pollution free, they're among the cleanest and greenest power sources yet developed. Are they all they're promised to be? Let's take a closer look at how they work…

There are really just two ways to power a modern car. Most cars on the road today use an internal-combustion engine (ICE) to burn petroleum-based fuel, generate heat, and push pistons up and down to drive the transmission and the wheels. Electric cars work an entirely different way. Instead of an engine, they rely on batteries that feed electric power to electric motors that drive the wheels directly. Hybrid cars have both internal-combustion engines and electric motors and switch between the two to suit the driving conditions.

Fuel cells are a bit like a cross between an internal-combustion engine and battery power. Like an internal-combustion engine, they make power by using fuel from a tank (though the fuel is pressurized hydrogen gas rather than gasoline or diesel). But, unlike an engine, a fuel cell doesn't burn the hydrogen. Instead, it's fused chemically with oxygen from the air to make water. In the process, which resembles what happens in a battery, electricity is released and this is used to power an electric motor (or motors) that can drive a vehicle. The only waste product is the water—and that's so pure you can drink it!

Think of fuel cells as batteries that never run flat. Instead of slowly depleting the chemicals inside them (as normal batteries do), fuel cells run on a steady supply of hydrogen and keep making electricity for as long as there's fuel in the tank. What happens in a fuel cell is called an electrochemical reaction. It's a chemical reaction, because it involves two chemicals joining together, but it's an electrical reaction too because electricity is produced as the reaction runs its course.

People have been heralding fuel cells as the next big thing in power supplies since the 1960s, when the Apollo space rockets first demonstrated that the technology was practical. Four decades later, there are hardly any fuel-cell cars on our streets—for a variety of reasons. First, the world is geared up to producing gasoline engines by the million, so they're naturally much cheaper, better tested, and more reliable. You can buy an ordinary car for a few thousand dollars/pounds but, until recently, a fuel-cell car would have set you back hundreds of thousands. (Toyota's "relatively affordable" Mirai finally became widely available in 2016 at a cost of just under US$60,000, twice the price of its hybrid Prius.) Cost isn't the only problem. There's also a massive oil-based economy to support gasoline engines: there are garages everywhere that can service gasoline-powered cars and filling stations all over the place to supply them with fuel. By contrast, hardly anyone knows anything about fuel-cell cars and there are virtually no filling stations supplying pressurized hydrogen. The "hydrogen economy" is a far-off dream.